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No.
SO-ITF-SM-18

***Bucida buceras* L.**

Ucar

Combrataceae

Combretum family

John K. Francis

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Bucida buceras L., also known as ucar (12), pucte (9), and oxhorn bucera (13), is a dominant tree in dry and moist forest stands (fig. 1) and is popular as a shade tree in many urban areas. Its potential as a timber tree has not been fully appreciated.

HABITAT

Native Range

The native range of ucar falls between 5° N and 25° N latitudes and includes the islands of the Bahamas, Cuba, Jamaica, Hispaniola, Puerto Rico, and the Lesser Antilles as far south as Guadalupe (12). On the mainland, the species grows from southern Mexico through the Guianas (fig. 2). The range was originally thought to have included the Florida keys (27), but apparently ucar was not found in this area prior to colonization (11). Ucar is widely planted as an ornamental and shade tree in south Florida and the West Indies.

Climate

Ucar grows naturally in Puerto Rico where areas receive between 750 and 1400 mm of rainfall and the winter dry season lasts about 2 months. In the Yucatan Peninsula of Mexico, it grows in areas receiving less than 2000 mm of rainfall with a dry season from November to March (5). Mean annual air temperature across the range varies from about 24 to 28 ° C (25), with greater diurnal than seasonal fluctuations.

Soils and Topography

Ucar grows best on nutrient-rich soils that are deep, medium textured, and moist but well drained. However, because its slow growth makes ucar a poor competitor on the better soils, most natural stands are found in low-rainfall areas, in saline soils on coastal areas (19, 20), and on excessively drained limestone outcrops and sand hills in areas receiving medium rainfall. The greatest concentration of well-formed trees occurs in swales and along intermittent streams in dry foothills (8, 20). Ucar is usually found in coastal areas (12), but may grow at elevations of several hundred meters on dry coastal hills and in interior areas of Central America. Ucar also grows at the margins and on hummocks of *Pterocarpus officinalis* Jacq. and mangrove swamps (5, 6, 20).

Associated Forest Cover

Ucar is a component of the climax community of the dry forest (22). It grows as a subclimax tree in excessively

drained areas of the moist forest. In the "thorn forests" in southern Mexico (Tabasco and Chiapas forests), it is associated with *Eugenia lundellii* Standl., *Coccoloba cozumelensis* Hemsl., and *Croton reflexifolius* H.B.K. (22). On the Yucatan peninsula ucar grows with *Manilkara zapota* (L.) V.Royen and *Swietenia macrophylla* King (22). In the limestone ridges of Cuba, between mangrove forests and at a maximum elevation of 450 m, ucar grows with *Calophyllum brasiliense* Camb., *Guaiacum officianale* L., *Pera bumelifolia* Griseb., and *Lysiloma latisiliqua* (L.) Benth. (24). In Puerto Rico, ucar is found in association with *Bursera simaruba* L. Sarg., *Acacia farnesiana* (L.) Willd., *Prosopis pallida* (H.+B. ex. Willd.) H.B.K., and *Leucaena leucocephala* (Lam.) de Wit. on dry hillsides and with *Andira inermis* (W. Wright), *Zanthoxylum martinicense* (Lam.) DC., *Homalium racemosum* Jacq., *C. brasiliense* Camb., and *Ceiba pentandra* (L.) Gaertn in moister areas.



Figure 1.—An ucar (*Bucida buceras*) tree growing in a natural moist forest stand in Puerto Rico.

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Figure 2.—The natural range of ucar (*Bucida buceras*).

In low-lying areas, it may be found in association with *Pterocarpus officinalis* Jacq., *Annona glabra* L., and *Drepanocarpus lanatus* (L.F.) G. F. Meyer in Haiti, with *Rhizophora mangle* L., *Avicennia germinans* (L.) L., *Conocarpus erectus* L., and *Laguncularia racemosa* (L.) Gaertn. in the Guayanas (5), and with *P. officinalis* Jacq. and *Calophyllum brasiliense* Camb. in Puerto Rico (6).

LIFE HISTORY

Reproduction and Early Growth

Flowering and Fruiting.—Flowering varies from tree to tree and can occur at any time of year in Puerto Rico (5, 12). Flowering takes place in the spring in Florida (16). The small greenish-white flowers, some of which are staminate and some perfect, are borne in spikes (2, 12). One-seeded drupes mature in about 3 months (27).

Seed Production and Dissemination.—Ucar seeds drop to the ground singly or as whole spikes and may be collected by hand from the ground or from the tree. Ucar seeds number about 38,000 per kilogram (5). No specialized means of seed transport are apparent. However, the seeds are light and easily blown a short distance in strong winds; seeds are also able to float.

Seedling Development.—Germination of ucar seed is epigeous. Germination is low, about 6 percent, and begins 12 to 17 days after sowing (5). Viability is lost quickly. A cutting test of 400 seeds from Puerto Rico showed that 64 percent had central cavities filled with woody material, 13.5 percent were hollow, 7 percent were infested with weevils, 3.5 percent were rotten, and 12 percent contained endosperm that appeared healthy. Only about 1 percent germinated, however (14). Moist sand has proven to be the best material for use in germination beds.¹ The final yield of seedlings in a nursery trial from one seed lot was 2,500 per kilogram of seed (5).

The growth of seedlings in Florida nurseries is reported to be slow (16). However, height growth of 15 seedlings grown in a nursery bed in Puerto Rico averaged 9 cm in 4 months, 21 cm in 5 months, and 47 cm in 6 months. Survival of potted seedlings has been high in Puerto Rican

planting trials, generally 80 to 100 percent, despite harsh site conditions. Optimum planting size appears to be when seedlings are about 10 cm in height. On the other hand, only 10 to 17 percent of bare-root or transplanted wildlings survived. Ucar seedlings have been planted in the open, in narrow cleared lines, and under shelterwood stands. After establishment, the canopy of the shelterwood was removed. All these methods appear to give good survival if healthy, potted stock is planted properly. The seedlings begin to grow very quickly in the field, and in one test conducted in Puerto Rico on soil that had better than average fertility, height averaged 1.8 m after 3 years, 4.0 m after 5 years, and 9.1 m after 10 years.

Vegetative Reproduction.—Ucar trees will coppice at least until they reach small sawlog size (30 cm in diameter at breast height, d.b.h.). The species is propagated for horticultural purposes using terminal softwood cuttings in a mist bed (16). Air layering is also an effective means of propagation (23).

Sapling and Pole Stage to Maturity

Growth and Yield.—Ucar rarely forms continuous stands; trees are found as scattered individuals or clumps of trees on the moister microsites in dry forests. However, the yield of ucar wood in these forests is not insignificant. For example, in 1951, 2.6 million board feet of ucar wood was converted to sawn and roundwood products in Cuba (24). Standing volume of ucar in the forests of Quintana Roo, Mexico, is about 2 m³/ha (9). Six 0.0314-ha sample plots centered in clumps of ucar in Puerto Rican moist and dry forests gave an average merchantable volume of 108±34 m³/ha within the clumps and ranged between 14 and 221 m³/ha (table 1). The clumps sampled probably were representative of 1 to 20 percent of the areas on which they were located. The areas in between contained scattered trees that were generally smaller in size and poorer in form. The diameter growth rate, measured between 1944 and 1961, of codominant ucar in natural stands of an unthinned dry forest in Guanica, Puerto Rico, was 1.3 mm/yr (1), while similar moist forest stands in Cambalache, Puerto Rico, grew 4.2 mm/yr between 1947 and 1950.

Two Puerto Rican plantations situated on shallow dry soil over porous limestone where rainfall was about 1400 mm/yr were also sampled. The plantations were 41 and 43 years old with an original spacing of 3 by 3 m. An average of 154 dominant and codominant trees per hectare had a mean d.b.h. of 20.2 cm and a mean height of 13.4 m (table 1). The dominants and codominants are just entering the smallest merchantable sawlog sizes. It is estimated that the rotation for ucar on this site would have to be at least 80 years for crop trees to reach a mean d.b.h. of 40 cm.

Equations for merchantable volume of ucar have been prepared using 20 cm as minimum d.b.h. and 15 cm as minimum top diameter (7). The equation used to calculate volumes cited previously is given below.

$$Vob = 0.00019818 D^{1.85328} L^{0.68674}$$

where: Vob = outside bark volume in m³

D = d.b.h.

L = merchantable bole length (merchantable height minus stump height)

$$Sy.x = 0.0794$$

$$FI = 0.993 \text{ (FI is analogous to } R^2 \text{)}$$

¹Personal communication from Alberto Rodriguez, Institute of Tropical Forestry, Southern Forest Experiment Station, Forest Service—USDA, Rio Piedras, Puerto Rico.

Rooting Habit.—Ucar seedlings quickly develop an extensive fibrous root system. Older ucar trees develop small buttresses and, on many sites, large superficial roots. Ucar does not have a reputation for raising sidewalks or curbs (29), but as the current extensive crop of ucar shade trees age, problems may appear.

Reaction to Competition.—Ucar is intolerant of shade. Most seedlings do not survive long under the parent trees, but in the dry forest a few saplings are almost always present in a suppressed condition at the somewhat sunnier boundaries between the crowns of large trees. Ucar seems to be able to maintain a dominant canopy position in the dry forest. In the moist forest, even on drier microsites, disturbance appears necessary to allow ucar saplings to gain a dominant position in the stand. Many ucar stands seem to be associated with past heavy grazing practices, possibly because cows pass over ucar for more palatable shrubs and grasses. Stand establishment may also be related to the fire protection afforded by the removal of the dry grass fuel by heavy grazing.

In the dry forest, competition for water may play as important a role in the survival of seedlings as light. It is certain, however, that available water dictates the success of large trees—the best trees are always found in moister microsites. The largest ucar known to the author, a 110-cm giant found in a stand with other impressive ucar trees, was growing on the flood plain of an intermittent stream. Basal area of this stand was 51 m²/ha. Average basal area for all the clumps sampled in Puerto Rico was 30 m²/ha.

Spacings of 3 by 3 m are suitable for planting ucar. In 10 to 20 years, the crowns will close, and the larger ucar will begin to suppress smaller trees if thinning is not carried out. Precommercial thinning should concentrate on eliminating low forked and crooked trees. Ucar reportedly has a crown-to-bole ratio of 33 (26). This would dictate an ultimate spacing of 12 to 15 m between trees.

Damaging Agents.—Probably the only serious threat to ucar in its native range is fire. The bark of ucar is thin, measuring only 1.2 to 2.2 cm in thickness (17), and trees surrounded by thick grass are easily killed or scarred by the periodic fires that sweep the dry habitat. Isolated trees

are more susceptible to fire in the absence of livestock because of a greater accumulation of fuel. Basal fire scars are the chief entry point for butt and heart rots. Ucar is said to be resistant to hurricane damage (23).

An unidentified mite is responsible for the horn-shaped gal that inspired the Latin name *Bucida bucerus*, meaning ox horn (2). The effect of the mite on reproduction is probably negligible. A whitefly, *Aleurodicus dispersus* Russell was noted to attack ornamental ucars in Florida (3).

Ucar wood is listed as resistant to the West Indian dry-wood termite, *Cryptotermes brevis* (Walker) (29), and subterranean termites (17). It is not resistant to marine borers (*Teredo* spp., 13) or wet-wood termites (*Nasutitermes* spp., 15). Wood from ucar is not durable when in contact with the ground (17).

SPECIAL USES

The density and hardness of ucar wood dictate to a large extent how it may be used. Densities apparently vary somewhat, depending on where the trees are grown. Cited densities for oven-dried wood were: 0.85 g/cm³ in Guatemala (10) and 0.75 g/cm³ in Mexico (9); those for air-dried wood were: 1.01 to 1.07 g/cm³ in Guatemala (8) and 1.10 g/cm³ in Puerto Rico (13). The wood seasons satisfactorily for so dense a species and shrinks little in the process: 1.3 to 3.0 percent radially and 2.3 to 6.6 percent tangentially (9, 13). The wood has a side hardness of 1,063 kg/cm², a modulus of rupture of 1,085 kg/cm², and a modulus of elasticity of 1.4 x 10⁵ kg/cm² (10). The wood is also reported to have an elevated silica content (17). For these reasons, ucar wood is difficult to work with both hand and power tools. However, the wood has an attractive dark yellowish-brown to greenish-brown color with a mottled grain and will finish to a glasslike surface. High-quality flooring and some furniture are manufactured from ucar. Additional high-value uses that have been suggested are doors and interior trim (9). Other uses include bridge and ship timbers, decking, pilings in waters without marine borers (*Teredo* spp.), posts, railroad ties, and pallets (9, 13). Ucar is a good fuelwood and makes excellent charcoal; the bark

Table 1.—Descriptive data for Puerto Rican plantations and natural stands of ucar (*Bucida buceras*)

Location	Age	Mean and SE		Crop trees	Merchantable volume
		D.b.h.	Height		
	Years	-----cm-----	---m---	No./ha	m ³ /ha
Plantations [#]					
Cambalache 16	41	19.3 ± 0.1	12 ± 1	159	12
Cambalache 21	43	21.0 ± 2.1	15 ± 1	148	34
Natural Stands					
Coamo 1	unknown	32.8 ± 2.7	20 ± 1	446*	198
Coamo 2	unknown	32.8 ± 4.8	16 ± 2	64	14 @
Coamo 3	<100	75.9 ± 17.1	28 ± 2	96	221
La Plena	unknown	43.2 ± 3.1	19 ± 1	96	74
Guanica	≈ 45	12.3 ± 1.3	11 ± 1	159	40
Cambalache 3	uneven aged	17.6 ± 3.7	14 ± 1	159	99

[#]Only dominants and codominants were measured.

*Represents clumps only; actual standing volumes across larger areas are much lower.

@The larger trees were cull due to heart rot and did not contribute to the merchantable volume data.

is used for tanning (21). Ucar is listed as a honey tree, although its nectar flow cannot be relied on every year (4).

Ucar has become an important shade tree in coastal areas of the West Indies. It resists air pollution and salt spray, and grows well in various soils, including fill dirt. Its small, round leaves and semipendulous branches make it appealing for landscaping. Wild trees are usually thorny and variable in form, but selected cultivars now used are thornless and have uniform foliage. Ucar should not be used for shade where cars will be parked regularly because a dark, sticky exudate falls continually from the trees.

GENETICS

There are two species in the genus *Bucida*. The other species, *B. spinosa* (Northrop) Jennings is also native to the West Indies region (2). No genetic studies of ucar are known.

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